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THE ROSE TECHNIC.

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IT is the happy privilege of THE TECHNIC this month to extend to Col. Thompson, president of the Board of Managers, congratulations upon the attainment of his eighty-fifth anniversary. The event, which occurred the 9th inst., was celebrated by a reception at the opera house. Although Col. Thompson has achieved a national reputation it is also as a friend to and a co-laborer in the interests of Rose Polytechnic that he is endeared to all connected with the Institution. That the pleasant experience which made the day such a memorable one may be repeated many times, is the sincere hope of THE TECHNIC.

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OFFICIAL announcement is made to all honorary members of THE TECHNIC board that at the suggestion of the retiring members of this year that the complimentary list has been discontinued. The list has begun to assume such proportions that it would soon have become a burden, and hereafter previous dealings with the business manager must occur to insure the regular delivery of the journal.

WITH this number the Senior members of the staff retire from the management of THE TECHNIC. The last of those connected with the founding of this journal three years ago must now say good bye. We have watched the trials and triumphs of this paper with a fatherly interest and it is our pleasure to now leave the working out to greater excellence in the hands of those who have come to it as one of the successful, well grounded institutions of Rose Polytechnic. The exacting nature of the work of our Institute does not at all times lead along the path of journalistic interests and frequently the editors have found two calls of duty most harassingly conflicting within the shadows of which a number of the journal has been evolved. If the signs of the struggle have been too plainly apparent we must crave your indulgence.

In the interest of the new editors and especially of the editor-in-chief, we would most emphatically emphasize the fact that each one has his full quota of school work to carry and that the editorial work must be performed in that differential of time, his leisure moments. When manuscript is promised for a certain date the editor is as a matter of politeness supposed to believe that the pledge will be kept, whatever conclusion hard experience may force upon him. He has no time to be continually reminding contributors of their promises and a sense of delicacy, by the way soon blunted, gives him the less inclination to do so considering the imputation on another's veracity that it carries. It is perhaps impossible to fix an unvarying date of publication, but more attention to the fact that the editor-in-chief cannot bring out a paper until the copy is in and that he is not the only one having responsibility in the matter will aid the approach to a regular date of issue.

It is with every confidence that THE ROSE TECHNIC will be maintained in the higher class of college journals, and that the measure of approval already accorded it will be more and more mer-

ited that the retiring editors bid the journal God speed, We are pleased to announce that Mr. H. H. Meadows '96 will have editorial control of THE TECHNIC during the coming year. Mr. A. V. Tuller, '95, takes up the Alumni department; Mr. Ingle will edit the College World division and Mr. H. T. Liggett has consented to take up the Local work. The business management remains in the same efficient hands. Other positions will be filled early in the year.

We desire to make public recognition of the help and favors extended to us by our publishers, Messrs. Moore & Langen and to Mr. Bell, head of the composition department. The mechanical excellence of THE TECHNIC we have always been proud of, and not the least of the pleasant things of our connection with THE TECHNIC have been the relations with these gentlemen who have wrought it.

Trusting that the students of R. P. I. and the business men of Terre Haute will continue the liberal support so generously accorded THE TECHNIC in the past, we again say farewell and may this journal grow ever more worthy of the noble institution it represents.

* * *

ANOTHER pennant added to the collection and chronologically Field Day of 1894 is a thing of the past. Not so though in the minds of Rose men, ask any one of them to name the most thoroughly enjoyed days of the college year and we think Field Day would head the list. The glorious record of successes in this the most recent of the intercollegiate meets shows that even the vaunted athletic superiority of past years is being constantly strengthened. The Rose man naturally takes to Field Day and from our observation appears as naturally to take everything in sight away from it also. There is no question but that May 29th was a Rose day, from the base ball victory in the morning to the late evening march around the Soldiers Monument of the escort of honor guarding the pennant little had been left for us to desire. True there were defeats where victories had been expected, but the development of totally unexpected strength in other lines occurred in such gratifying quantities that the score of points was larger than calculated previously by the most sanguine followers of the rose and white. That the institution having by far the smallest enrollment and the longest working hours of any in the league has successfully held the field against all comers ever since the sports were inaugurated speaks volumes for the grit and determination of its students. The practice of encouraging each man manifesting any sort of ability to go in and do his best regardless of previous records is good and its true value was shown this year in the "surprise" points won. The enthusiastic support of fellow students always assured to R. P. I. athletes at the contests is certainly an incentive to best efforts. It will not be far wrong to say that a portion of our winning scores has had its origin in the grand stand. We might go on for pages citing those things which contribute to success, the above are mentioned because they seem to been elementary in gaining and keeping the distinction again vouchsafed to us but little over two weeks ago. The essence of the whole matter has certainly been tersely expressed in a line of one of the improved yells gently wafted through the ambient air from a hundred or more cultured throats on the occasion of the late festivities: "You bet, you bet, we know our biz." There is a world of truth in the above somewhat non-classical expression of the thought and there seems to be no immediate prospect of R. P. I. suddenly forgetting the valuable knowledge so modestly claimed.

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WE have said that Field Day was highly enjoyable to Rose men, not on account of the "superior" management by a general committee, but in spite of it. Not in any "I told you so" spirit but because the facts in the case justify it we say that almost every objection previously urged to such arrangements in these columns and again by our representatives at the spring business meeting in Indianapolis were verified in the actual experience. Responsibility for failure or success was so widely distributed that its weight seemed scarcely felt. To the casual observer the

first screw loose was noticed in the street car service, apparently no request for extra accommodations having been made. The attendance was no doubt greatly cut down by this one thing. To see one crowded car after another pass at intervals of fifteen or twenty minutes and no chance of obtaining a foothold even, was enough to shake the determination of a college man directly interested. On the grounds scarcely any evidences of preparation greeted the eyes of those arriving at the scheduled time for the first event to be called. To those who did not appreciate the difficulty of working off before darkness the long series of events even when begun in season, the operation of measuring running courses, laying tapes, etc., may have been intensely fascinating, but the experienced Rose delegation was inclined to fidget.

A homelike feeling prevaded the grand stand, old rose here, there, and all around telling plainly the college affiliations, but the promised bands from other colleges were nowhere in evidence. Without the Polytechnic train load of spectators and Rose influence in the capitol city, most serious financial loss would have resulted. All these and other considerations leads THE TECHNIC to re-avow its loyalty to the platform of a single college supervision and control of Field Day. This idea will probably grow stronger in the minds of the Indianapolis business men who went down into their pockets to pay up their assessments on the guarantee fund, and they will politely refuse to subscribe to a fund which with proper management would not have been levied upon this year.

* * *

ATHLETIC victories we make the subject of rejoicing, our conversation largely tends to them, the columns of our college papers we fill with glowing accounts of our prowess, but these things we appreciate are but incidental happenings in the work of our college course. As an invigorating relaxation from confining studies that leaves the mind clearer, the will more fixed in the attacks upon difficult problems, we interest ourselves in these outside matters. We feel much gratified if we are the successful ones in the trials of strength and skill, yet it is not in the athletic prestige that the wise man gauges the college. The thoroughness of its work, the value of its preparation for the duties of life, the attainments of its graduates are the things that decide his opinion. A happy case is that in which all factors are combined.

SENIOR THESES.

It is our endeavor to herewith present to our readers the main points of the theses work of the graduating class of '94. The task of condensing some fifteen or twenty pages of type written matter, which is the average length of these documents, into an abstract of three or four hundred words is not an easy one. Many points of interest and value must be omitted, and the following reports can only be regarded as finger posts pointing out the paths followed in the various investigations.

AN INVESTIGATION IN ORGANIC CHEMISTRY.—ELMER BROWN.

As a hydrogen atom in a methylene group in a compound which contains a carbonyl group adjacent to the methylene group can be replaced by a methyl, it was thought that in the nitro compounds also a methyl group could be introduced in a similar manner. Victor Meyer, a very noted chemist, has worked with these nitro compounds with negative results but it was thought that in a few special cases the introduction of the new group might be accomplished. Therefore an at-

tempt was made to introduce a methyl in the methylene group contained in di-nitro-phenyl-benzyl-methane by means of sodium-ethylate and methyl iodide. As is the case of work which has been done before on this addition of a new group, the work resulted negatively, that is, the introduction was not accomplished.

Now the study of several derivatives of camphoric acid was taken up, especially the study of the anhydride of di-hydro-amino-campholytic acid and its isomer the anhydride of amino-lauronic acid. They were prepared by the action of quicklime on di-hydro-amino-campholytic acid and on amino-lauronic acid. These re-actions gave the anhydrides of the two acids and the two anhydrides were analyzed to determine their composition. They were found to be isomers with the formulæ, $C_8H_{14}\overset{CO}{\underset{NH}{}}$ and $C_8H_{14}\overset{NH}{\underset{CO}{}}$.

MAGNETIC PERMEABILITY OF IRON AND STEEL.—S. L. HENRIKSON.

This subject was taken up with the intention of comparing the magnetic properties of several kinds of iron and steel used in electrical work.

With the exception of a preliminary test in which a magnetometer and scale was used, one of the so-called induction methods was adopted. The following apparatus was used:

A cast iron frame or rectangle was made, of cross section sufficient to offer no appreciable reluctance and having holes bored through the ends or shorter sides to admit the specimens. The latter were of wrought iron, mild steel, tool steel and cast iron, each being in two parts, half an inch in diameter and six inches long. The inner ends which were faced accurately true were allowed to meet in the middle of the frame, forming in this way a closed magnetic circuit of the "iron-clad" type.

Surrounding each half of the specimen was a coil in which the field could be varied continuously from zero to 3,000 lines per square inch. Around the junction of the two halves of the specimen was a small exploring coil so arranged that it could be pulled out of the circuit when the specimen was subjected to a known field and separated. This coil was connected to a Thompson astatic galvanometer of slow period, which by its deflection or throw measured the change of induction through the coil.

By taking a sufficient number of such observations and plotting their values to co-ordinates of field intensity and corresponding inductions, the permeability curve of any specimen was obtained.

A comparison between the curves thus found shows to what degree a given field will magnetize any specimen examined, and shows in general the behavior of the ordinary kinds of iron and steel when subjected to magnetizing forces.

THE EFFECT OF SUDDENLY APPLIED LOADS UPON THE TENSILE STRENGTH OF WROUGHT IRON.—E. F. ROBINSON AND J. C. C. HOLDING.

There has been much discussion upon the question, "Is the elastic limit of a given specimen of iron or steel the same under all circumstances or does it vary according as the load is a sudden shock, or a continuous pull?"

Since in stretching any specimen to its elastic limit work must be done upon it, it would seem to be evident theoretically that this work would be of constant quantity, independent of the manner of loading, and therefore that the elastic limit would be the same whether the load were suddenly or gradually applied.

The results of former experiments did not seem to be in accordance with this principle and it was the object of this thesis to establish experimentally, if possible, its truth.

Our apparatus for the impact test consisted primarily of two pendulums. These were simply two large blocks of cast iron suspended from a frame by double suspension, so that their centers of gravity were in a horizontal line. The specimen, which was a rod about three and a half feet long with upset ends, was slipped through a hole in one of the pendulum blocks and clamped. Nuts were then screwed upon the ends.

The other pendulum block had left in its lower surface a deep trench, broad enough to span the specimen. It is plain that when everything is properly adjusted, and the second pendulum raised toward the other and released, that it will

strike against the nut on the end of the specimen producing in the latter a tensile stress, and at the same time swinging the first pendulum. The energy af the drop pendulum at impact is the product of its weight and distance dropped. The energy imported to upper pendulum is the product of its weight and the height to which it swings. The difference of these two energies must have been used in stretching the bar.

Thus we have a means of determining the work done upon the specimen to bring it to its elastic limit, if the pendulum heights are observed just when the first permanent "set" appears. This work per unit volume of the material *i. e.* its elastic resilience, we found to be about 79 in inch-pound units. The same quantity as found by the ordinary method of testing was about 20. Thus our dynamic method gave a resilience almost four times greater than the static method, and yet when we consider that other impact tests have given a resilience sixty times too great, we believe that we have made a decided advance in accounting for the energy of impact, and when other causes of loss, such as the vibration of the pendulum suspensions have been eliminated that the elastic limit will be found to be independent of the manner of applying the load.

A STUDY OF THE PLANT OF THE CITIZENS' GAS AND FUEL CO.—W. M. BLINKS AND A. V. H. MOREY.

The gas supplied by the Citizens' Company is made by the destructive distillation of crude petroleum, most of which is obtained from the wells in this city. The distillation is accomplished by spraying the oil upon heated brick checker work in a large cylinder of boiler steel.

The brick work cools rapidly in the operation and at the end of about seven minutes reheating must be begun. In this operation the oil is sprayed in along with sufficient air for combustion. The gas coming directly from the generator is too rich to burn in the ordinary burners, hence it is diluted in the seal box with air. Purification is effected in the ordinary manner.

A representative analysis of the gas gives the following composition:

C O_2—0.7 per cent; illuminants—19.3 per cent; O—7.0 per cent; C O—0.0 per cent; C H_4—33.2 H—6.9 per cent; N—32.9 per cent.

The larger part of the illuminants was found to be ethylene, propylene coming next in considerable quantities, and we were led to the conclusion that di-vingl was also present. An average of 1.2 per cent. of the total gas or ,6 per cent of the illuminants was found to be benzene vapor.

Only a comparatively small amount of tar is formed in the process, and this amount varies considerably with the conditions of running. Several samples of the tar were studied with a view to separating and identifying the various hydrocarbons present. Naphthalene was separated in considerable quantities, but neither benzene nor carbolic acid were found.

Search for the higher boiling constituents was next begun, and for this purpose the tar was distilled from an iron retort in a gas furnace. Oils began coming over between 500° and 600° F. and continued long after the retort was nearly white hot. Among the solid, high-boiling hydrocarbons found were anthracene, the basis of the dyestuff alizarin; chrysene, boiling at about 800° F.; a green crystalline solid, not identified, boiling at about 900° F.; and a dull yellow body, also crystalline coming over at a red heat. Besides these and various paraffin oils there were present certain solid hydrocarbons that could not be separated in anything like a pure condition, or were lost in attempt at recrystalization.

The study of the plant which was begun the latter part of February was recently concluded by a test of the candle power of the gas, using different burners under varying conditions. The interesting fact was confirmed, that an ordinary bat wing burner is most efficient when burning with a smooth flame, and least efficient when burning with a large forked flame. An argand burner, consuming five cubic feet per hour, which is the standard condition, developed over 28-candle power, while a 5-foot bat wing burning the same amount of gas, gave over 31-candle power.

The heating effect of the gas is high. The value of 740 English heat units per cubic foot was found from calculations based on analyses. Thus the

Welsbach, and such other burners as depend for their efficiency upon incandescence, may be used to advantage. A small Welsbach burning a little over three cubic feet per hour developed over 31-candle power, and a large one with six feet of gas gave over 57-candle power.

EFFICIENCY TEST OF THE UNION STATION LIGHTING PLANT. —DAVID McCULLOCH AND PAUL MISCHLER.

The engine of the Union Station Lighting Plant is a 10x12 high speed, center crank, 40 horse power Atlas engine with an automatic governor and is belted direct to a Westinghouse compound-wound, short shunt, direct current, 500 light dynamo.

The test consisted of two parts:

First. A test of the engine by means of which the ratio of brake to indicated horse power, or the mechanical efficiency, was determined for different loads. From this ratio the curve of the engine was plotted.

Second. A test of the dynamo, as a result of which, the efficiency of conversion, the electrical and the commercial efficiencies of the machine were ascertained.

THE ENGINE TEST.

In the engine test, indicator cards were taken from the engine and a brake load, which was varied at intervals of five horse power from zero to the maximum capacity of the engine, was applied at the fly wheel, six cards being taken for each load. The brake used was in the form of a strap, lapped once around the fly wheel and the tension at one end of the strap was measured by means of a spring dynamometer, at the other end by a balancing weight on a scale pan.

THE DYNAMO TEST.

The test of the dynamo was effected by introducing resistance in the external circuit thus producing the load. The resistance of the available lamps was found to be insufficient to give the full load of the dynamo, hence a low resistance was placed in series with the lamps, in the external circuit; then by different combinations, the load was varied from zero to the maximum load of the machine. Indicator cards taken from the engine for each load gave the indicated horse power for that load, and the brake horse power was measured from the curve of the engine previously determined.

In measuring the current in the external circuit, a magneto-static ammeter was used, the current being too great for the limited range of the Weston Standard Ammeter. The magneto-static instrument was standardized by joining it in series with the Weston and noting the readings of each instrument for the same current. Thus the relation between the two was determined.

The efficiency of conversion of the dynamo is the ratio of the total electrical energy actually converted in the armature, to the brake horse power of the engine. The maximum value was 96.5 per cent. for 32.1 brake horse power.

The electrical efficiency is the ratio of the electrical energy in the external circuit, to the total electrical energy converted in the armature. This maximum value was found to be 95.9 per cent. for a brake load of 25 horse power.

The commercial efficiency is the ratio of the energy available for lighting to the energy required to drive the dynamo and is also equal to the product of the two preceding efficiencies. Its greatest value was 91 per cent., the brake load being 25 horse power.

As a final result of the test we find the maximum efficiency of the entire plant is reached at 37 indicated horse power and is here 74.8 per cent. The energy available for lighting under these conditions was found to be 27.9 electrical horse power.

BRIDGE DEFLECTIONS.—M. C. ANDREWS AND F. F. HILDRETH.

The deflection of bridge trusses under train loads either at rest or in motion is a subject toward which only a limited amount of investigation has been directed in this country. Representatives of the engineering profession in France and Germany have, however, given the subject more attention, but the results of their research are not generally known, or if known not fully appreciated. The expense necessary to prepare suitable apparatus for this purpose seems too great

in proportion to the benefit to be derived from an ordinary deflection diagram.

A number of experiments on this subject was made by Prof. Robinson of the Ohio State University, and the diagrams recorded by his apparatus present many interesting features, but differ in many respec s to those obtained by us. The experiments of Messrs. Rose and Tinsley of the Class of '92 of this Institute suggested several points which were followed to advantage by us.

The object of our experiments was 1st, to make a continuous record of the vertical, lateral and endwise movements of a bridge truss produced by trains moving over the structure with varying velocities, and 2d, to analyze these diagrams for the purpose of observing the action due to different loads moving at different velocities.

The first series of experiments was performed on the west span of the Vandalia bridge over the Wabash river in this city. A scaffold was erected at mid span and to the top of this was fastened a box having an adjustable top. The recording machine was fastened to this box and direct connection made to the lower chord of the bridge at the panel point exactly at mid span. The apparatus used in measuring the movements of the bridge consisted of three sets of levers which recorded the movements of the bridge in three directions at right angles. Each of these sets of levers moved a pen which made a continuous record on a strip of paper. On this same strip of paper records were made by four other pens, three of which had electrical connections with the bridge and were used to determine the position and velocity of the train at any instant, and the fourth to record seconds.

Fifty-six diagrams were taken during an interval which extended over six days, and deflections were recorded of all classes of trains which pass over the Vandalia R. R. These diagrams showed a similarity in general appearance, but each exhibited peculiarities which showed that the same train in passing over the bridge at different times would produce somewhat different results, although the maximum vertical deflection was practically the same.

The lateral vibration of the bridge appeared to indicate a period of vibration characteristic of the bridge and not of the load or its velocity. The period of vibration of this bridge was found to be about half a second. The maximum vertical deflection for any train always occurred while the engine was passing the middle of the bridge. The greatest deflection observed was $\frac{65}{100}$ of an inch and was caused by a 70-ton engine pulling a train of mail and express cars.

A second set of experiments was taken from the Big 4 bridge over the Wabash in this city and with results very similar to those obtained at the Vandalia bridge.

The records obtained by us in these two sets of experiments seemed to point to the following conclusions: 1st, that the period of lateral vibration is a function of the bridge and not of the load or its velocity and is practically constant for any bridge. 2nd, that the vertical deflection of a bridge depends upon the weight of the load and not upon its velocity while crossing the span. 3rd, that the movement of the bridge endwise is always in the direction of the roller end of the truss. And 4th, that the effects generally supposed to be caused by impact of a train are very small.

DENSITIES AND SPECIFIC HEATS OF SOLUTIONS OF COPPER SULPHATE AND SILVER NITRATE —H. G. KILBOURNE

In comparing the results on densities of solutions as given by different observers, they were found to vary considerably, partly due no doubt, to the different conditions and methods employed in the determinations, and partly to the degree of care and accuracy of the observers.

These differences led to the selection of the subject of densities for a thesis work. The original intention was to work as far as possible under the same conditions, as previous observers had done, and compare the results obtained with those given However, it was found impossible to carry out the work as intended as the results given were not accompanied, with one or two exceptions, by sufficient detail in regard to the methods and conditions employed, and the corrections made in the final calculations, to insure an accurate or even a safe basis of

comparison. In view of these facts the experimental work herein described was carried out on an independent basis. The question arose, along with that of densities, concerning the specific heats of solutions of different percentages of concentration. It was, therefore, thought advisable to combine the two lines of study, and determine first the densities, and second the specific heats of the solutions at hand.

The first experiments were made with copper sulphate solutions, the second with solutions of silver nitrate. The copper sulphate was first purified and recrystallized. In both cases the salts were carefully analyzed before the solutions were made up. The percentage of concentrations were calculated from the parts by weight of the salt in one hundred parts by weight of the solution. The method employed in determining the densities consisted in the direct comparison of the density of the solution with the density of the water at the same temperature, and under the same conditions. The temperature taken was twenty degrees centrigrade. A small glass bulb was blown to be used as a sinker, and a small quantity of mercury sealed within it. A very fine platinum wire was sealed in the stem of this sinker and the latter suspended by means of the wire from the arms of a balance. It was weighed first in the air, then in water at twenty degrees, and lastly in the solution at twenty degrees. The ratio of these weights then gave a direct comparison of the densities of the two liquids at twenty degrees. In weighing the sinker in water and in the solution, care was taken to have it completely immersed, and also to have the same amount of suspension wire immersed in each case. The liquids were placed in a small beaker, and surrounded with broken ice. being brought to a temperature below twenty degrees, they were then thoroughly mixed and the beaker placed upon the balance, the sinker was weighed accurately in the liquid, the weights being adjusted as the temperature increased, the final reading being taken when the thermometer registered twenty degrees. Care was taken in transfering the liquid and corrections were made for losses due to transfer, and evaporation in calculating the percentage of the solutions.

The method used for the determination of specific heats was planned by Prof. Gray. The specific heats were determined by an electric heating arrangement. Two celluloid cylinders were made of the same size, a coil of German silver resistance wire was wound on each, these coils were coated with several layers of celluloid prepared in liquid form. A thermo-electric pile was made, with junctions of German silver and iron wire, these were also coated with celluloid. Two cells, consisting of glass beakers of two sizes were made, the larger being used to jacket the smaller. Care was taken in making these cells to have them as nearly uniform as possible. The two heaters with their respective thermo-piles and cells were of nearly the same heat capacity. The theory of the method is that two such heaters of nearly the same resistance and heat capacity, and with the same constant electric current, working under the same conditions would receive and radiate equal quantities of heat. If one were placed in a solution of some salt, and the other in the same amount of water, the rise in temperature of the two liquids would be proportional to their specific heats. Taking, therefore, equal weights of solution and water and adding water to the original amount taken until the rate of heating in each, as indicated by the thermo-pile with galvanometer, was the same and remained constant, the specific heats of the two liquids would be directly proportional to the weights.

This would give only an approximate result, if then corrections were made for the difference in heat capacities of the two heaters and cells, the difference in the resistance of the two coils in the heaters, and the variation in current, the result obtained would be fairly accurate.

TEST OF THE NEW EXPERIMENTAL DYNAMO OF THE INSTITUTE —O. R. HEDDEN AND EDWARD RIEDEL.

At this writing we are unable to give any of the results of the test as none of them have been computed, but since a large portion of the time allotted for thesis work was spent in construction of the machine, a brief description of the machine and its purpose cannot be out of place in this article.

The dynamo was designed in 1892 by Mr. S. S. Wales of the class of 1891 during his post graduate course at the Institute and the entire machine was built at the Institute shop.

The machine is a compound-wound bi-polar dynamo of the well-known Gramme ring type. The shunt coil is made up of 4,000 turns of No. 16 (B and S) wire; the series coil of 80 turns of No. 6 wire. The commutator is composed of 40 segments of so-called tempered copper insulated by mica. The armature is wound with 40 coils of wire with 5 turns per coil. The speed of the dynamo is given as 1500 revolutions per minute to yield 4,000 watts.

One noticable feature of this dynamo is the steel brushes instead of carbon or copper. The advantage claimed for the steel brush is that in offers less electrical resistance, and hence produces less loss of electrical energy than carbon and does not wear away as rapidly as copper.

In order to adapt the machine especially to experimental purposes, it is provided with a switch board so arranged that the dynamo may be run either as a series, shunt or compound machine. The shunt coil is wound in ten sections which may be joined in parallel or series or any number of which may be joined in parallel and the set thus formed may be joined in series by means of the switch board.

From the result of a preliminary test made with temporary field coils to determine the magnetic nature of the iron and from this the winding of the field coils, we are sure of a high degree of efficiency.

A STUDY OF STRAINS IN IRON RAILWAY BRIDGES UNDER DIFFERENT CONDITIONS OF LOADING.—G. H. WINTERS.

Ordinarily we think of iron as being a perfectly rigid substance. For the most part this is practically true, but taking the actual state of affairs we find that when we apply, let us say a pull on a bar of iron, take for instance an eye bar, we find that the bar stretches a certain definite amount depending directly on the magnitude of the pull and inversly on the area of the bar, supposed uniform in cross section.

No matter how small the intensity of stress is a distortion is present. In other words if we take an eye bar, such as was experimented on, whose section was rectangular $4'' \times 12''$, and apply a pull of one pound we will get a certain stretch and if 1,000 pounds be applied the elongation will be just 1,000 times as great as before.

Now if we take a bridge member in its working condition, select two joints at some known distance apart, arrange a machine to record the relative movement of these two joints, we have a measure of the stress to which the member was subjected, or to put it concisely, weighing the load in a manner exactly similar to the spring balance style.

This was what was attempted to be done together with the recording of the velocity and position at any instant of the train.

The amount of relative motion of two points three feet apart on a bridge member in a correctly designed bridge is very minute being about $\frac{1}{1000}$ of an inch for an intensity of stress of 10,000 pounds to the square inch.

TEST OF CLERK GAS ENGINE—J. S. ROYSE AND H. M. STANTON.

A test of this engine, made in connection with steam engineering practice last fall, had shown the need of a better igniting arrangement. Not only was the machine difficult to start, but there was an average failure to explode of 12 times to each 100 charges of gas.

In the present test, by substituting the electric-spark for gas-flame ignition, the energy used to drive a slide-valve and its necessary connecting pieces was saved, and the failure to explode reduced to less than 1 per cent. The electric igniting arrangement consisted of a rod or contact-piece screwed vertically into an insulated bushing which penetrated the clearance-space directly above the valve admitting the explosive mixture. Another rod attached to the piston and notched at the end formed the other contact-piece. One battery wire was attached to the insulated rod, the other to any convenient part of the engine. The engine is single-acting, and on the back-stroke the moving contact-piece brushes past the insulat-

ed one, causing a spark to ignite the mixture. Increase or decrease of the length of the moving rod hastens or retards the time of ignition in the cycle of operations, and as the contacts wear away, lowering of the vertical rod gives a ready means of adjustment. Indicator diagrams gave an idea of the time required for the gases to burn and attain their maximum pressure, and led to such adjustment that ignition occurred before the end of the back-stroke.

A water-jacket was made for the connections between indicator and engine cylinder, in order to preserve the temper of the indicator-spring.

A sheet-iron drum, 30x30 inches, with 5 orifices of known dimensions, water-gauge and sheet-rubber end-coverings was used as an air-meter; a curve showing the results of an experimental calibration of this instrument by members of the class of '92, was kindly furnished by Mr. W. A. Layman.

A band-brake encircled one fly-wheel, and during each run the weights on the brake-lever were not disturbed, proper running of the machine being secured by adjustment of valve in the gas supply-pipe. A series of indicator diagrams were taken to show the behavior of the gases in the cylinder while working under various loads, but for determination of the work done in the cylinder we used an instrument designed by Prof. C. S. Brown and recently constructed in the Institute shops. This continuous indicator, or integrator, sums up the mean effective pressures for every stroke in the entire run. A speed counter was attached to the same pantagraph to which the indicator cord was fastened. At two-minute intervals readings of the indicator, speed-counter, pyrometer, brake dynamometer, gas meter and air meter, while at four-minute intervals the weight and temperature of the jacket water were noted. For a friction run of the engine a thermodynamic efficiency of 3.6 per cent. was obtained. When the engine was running at its maximum horse power a thermodynamic efficiency of 9.2 per cent. was obtained while the mechanical efficiency was 67.8 per cent.

VOLUMETRIC DETERMINATION OF PHOSPHORUS IN STEELS.—E. D. FROHMAN.

Many of the volumetric methods used to determine phosphorus in iron and steels depend upon the precipitation of phosphorus, as phospho-molybdate of ammonium, by a molybdate solution.

The phospho-molybdate of ammonium is dissolved in ammonia, sulphuric acid is added and the solution is reduced in a Jones' reductor. This reductor consists of a long tube filled with pure zinc. This reduced molybdate is, then, re-oxidized by means of a solution of Potassium Permanganate. Two things must be known before the amounts of phosphorus can be determined. First. To what form is the molybdenum reduced? Second. What is the relation between molybdenum and phosphorus in the yellow precipitates.

The form of the reduced molybdenum was found by taking a solution of pure sodium molybdate and reducing. It was found that when the solution was reduced in an atmosphere of hydrogen or carbondioxide the reduced form corresponded to the oxide $Mo_2 O_3$. Some ammonium molybdate was also reduced and here again the form of the reduced molybdenum was $Mo_2 O_3$. This molybdic oxide was quite easily oxidized in the air and this oxidation probably accounts for the form $Mo_{12} O_{19}$ given by Werneke to this reduced oxide. If this reduced solution was poured back and forth in the air, it required very nearly 17 per cent. less of oxygen.

The relation of phosphorus to molybdenum was established by means of sodium-phosphate of known strength. The phosphorus was precipitated as before by a molybate solution and using the form of the reduced molybdenum $Mo_2 O_3$, we found the amount of phosphorus by these means. The oxidized power of the permanganate solution in terms of iron was known. The relations of the oxidizing power of permanganate solution from iron to molybdenum being known, and finding through our last experiments that the theoretical relation of molybdenum to phosphorus holds good, the amounts of phosphorus can be determined

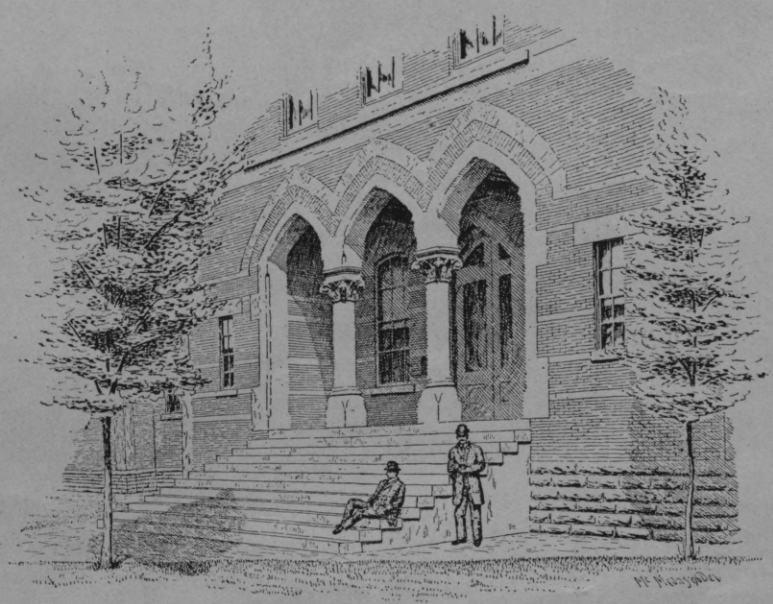
from the amounts permanganate solution used.

Beside the two solutions of sodium phosphate, we determined the phosphorus in steels, kindly sent us by C. P. Dudley of the Pennsylvania Railroad Company. The phosphorus in these steels had been determined gravimetrically. It was found that by reducing the ammonium phosphomolybdate with exclusion of air the theory is true, and that if our results were calculated from the *emperical* formula established by Dudley, our results were too high.

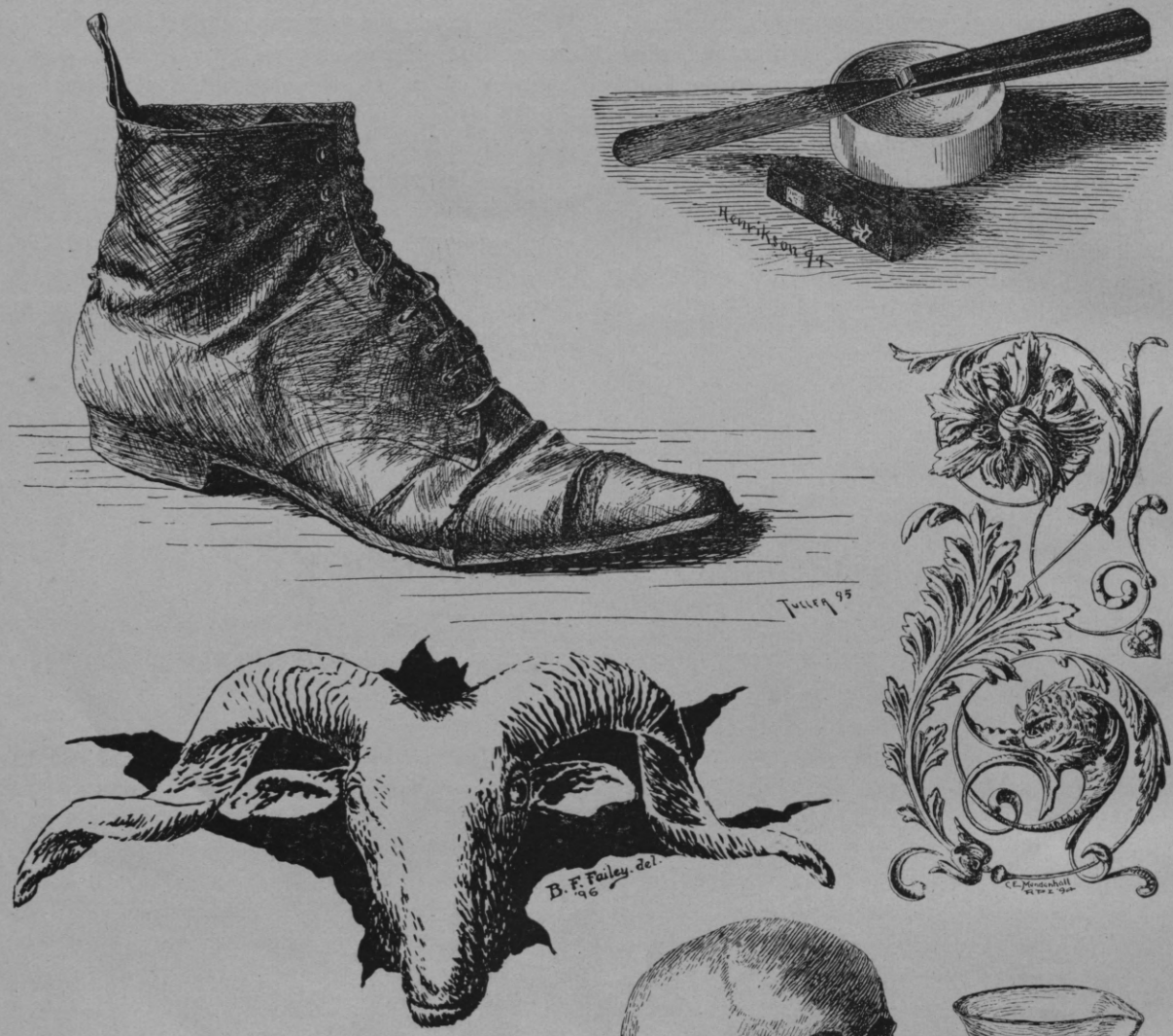
Some experiments were made by dissolving the ammonium-phospho molybdate in a caustic potash solution of known strength and neutralizing the caustic potash not used by an acid of known strength. From this the amounts of phosphorus can be determined as it is known how many molecules of caustic potash are equivalent to one of phosphorus. In these results we found that the results obtained were very nearly the same as those obtained by the reduction of the ammonium-phospho molybdate.

SOPHOMORE SKETCH BOOK.

The following sketches are photo-engravings—reduced size—of some of the drawings of the Sophomore Classes of 1892–3–4:



Every three years since the opening of the Institute the best pen and ink sketches made by members of the several Sophomore classes have been collected and reproduced by the photo-engraving process. The limited number of copies allowed each student is always eagerly sought and more wished



for, as the sketch books make most acceptable gifts to friends interested in the work of the Institute. The latest collection issued by the department of drawing comprises the work of students in the classes of '94, '95 and '96, and has not been surpassed in any of the previous issues. Where all the sketches are so good it is with hesitancy that we select any special ones and not all, but our space forbids the latter plan and we can give only a few representative prints from the cuts kindly placed at our disposal.

ALUMNI DEPARTMENT.

THE SEVENTH ANNUAL BANQUET.

Not being able to locate the Alumni editor since the banquet (this is no reflection upon his habits) we have borrowed from Editor Ball the following well written account of the banquet as it appeared in the *Gazette*:

The eighth annual meeting and banquet of the Alumni Association was held on Thursday evening at The Terre Haute. The business meeting was called at 8 o'clock. The president, Mr. C. B. Kidder, being unable to attend, Mr. H. W. Foltz, '86, of Indianapolis, the vice-president, called the meeting to order. The association listened to the reading of the minutes of the last meeting and the treasurer's report by Mr. J. B. Aikman, '87, secretary and treasurer, after which they proceeded to the election of officers, which resulted as follows:

W. R. McKeen, Jr., '89, president; A. V. H. Mory, '94, vice-president; executive committee, Hubert Kilbourne, '74, chairman; W. A. Layman, '92, Victor K. Hendricks, '89.

The office of secretary and treasurer is a permanent one, Mr. Aikman filling that position in a manner most satisfactorily to all.

A motion was proposed and unanimously adopted to the effect that it is the desire and pleasant privilege of the association to be honored at every meeting in the future as in the past with the presence of the Board of Managers and Faculty as guests of the Association.

At 9:30 o'clock there being no further business to engross their attention the members of the Association adjourned to the banquet hall, preceded by the toast master, Vice-President H. W. Foltz, who occupied the place of honor at the head of the table. Seated at his left was the secretary, while the Faculty and Board of Managers occupied seats on both the right and left. The remainder of the Alumni were seated in the order of the classes of which they were members.

The president in a few remarks proposed the Alumni yell, with which their banquets are always commenced and closed. It is the original school yell: "Rah! Rah! Rah! R.—P.—I. Rah! Rah! Rah!" and was given with a revival of college enthusiasm.

The following menu was served:

MENU.

Puree of Tomato, Amontilado.

Cavair Sandwiches.

White Fish—Butter Sauce.

Sliced Tomatoes, Cucumbers, Olives.

Fillet of Beef—Larded Cruse and Fils Claret.

Asparagus on Toast, New Potatoes.

LEMON SHERBERT.

Spring Chicken on Toast, Champagne.

Saratoga Chips.

Lettuce and Tomato Salad.

Strawberries and Cream,
Cheese and Crackers,
Coffee.

At the close of the banquet before any of the toasts were given the toast master proposed that they stand and drink to the health of the class of '94, which was done with considerable enthusiasm. Dr. Eddy responded to the toast, "The Alumnus," in a most acceptable and entertaining speech, which was received with much appreciation and applause. A telegram having been received from Mr. F. T. Hord, '88, that he would be unable to be present, Mr. George Chapman, '88, responded in his place. Numerous impromptu remarks were made by members representing all of the classes, and also by members of the Faculty and Board of Managers.

Very excellent music was furnished by a harp, flute and violin trio.

There were forty-six seated at the banquet table and while the Alumni have given some very delightful spreads in the past, none have ever equalled this one in point of satisfaction in arrangements and pleasure. The table in the large dining hall presented a most beautiful appearance and the serving, like the menu, was faultless. In the

center was a beautiful lamp amid banks of flowers and at each plate was a Marechiel Neil rose bud.

Those present were: Secretary Ray G. Jenckes and Hon. William Mack, of the Board of Managers; Pres. Eddy, Prof. Ames, Prof. Wickersham, Prof. Noyes, Prof. Mees, Prof. Brown, and Prof. Hathaway, of the faculty; Benjamin McKeen, M. '85, Herbert W. Foltz, M. '86, Charles M. Sames, M. '86, Charles E. Scott, M. '86, John B. Aikman, M. '87, Barclay G. Mering, M. '87, William H. Palmer, M. '87, George H. Chapman, M. '88, George M. Davis, LL. B., M. '88, John B. Peddle, M.'88.

CLASS OF '89.

Victor K. Hendricks, C., Herbert H. Holding, M., Wm. R. McKeen, Jr., M., Donn M. Roberts, M., Walter B. Wiley, Ch.

CLASS OF '90.

Samuel D. Collett, M., Mason Galloway, M.

CLASS OF '91.

William H. Harris, C., Horace B. Jones, M., Robert L. McCormick, C., Omar C. MeWhinney.

CLASS OF '92.

W. Arnold Layman, M.

CLASS OF '93.

Harry S. Hart, E., August H. Klotz, E.

CLASS OF '94.

Morton C. Andrews, State Line; Walter M. Blinks, Michigan City; Elmer Brown, Terre Haute; John F. Denehie, Terre Haute; Edward D. Frohman, Cincinnati, Ohio; Fred F. Hildreth, Bridge Hampton, N. Y.; J. C. Carlisle Holding, Terre Haute; Hubert J. Kilbourne, Terre Haute; David McCulloch, Indianapolis; Charles E. Mendenhall, Washington D. C.; Austin V. H. Mory, Manchester, Iowa; James S. Royse, Terre Haute; Howard M. Stanton, Indianapolis; George H. Winters, Dawn, Ohio.

NOTES.

A recent letter from L. S. Rose informs his friends at Rose that he is at present located in Springfield, Ohio, with the "Big 4" Co., and sends greeting to "the boys."

W. H. Albert, '93, and C. E. Albert, '93, of Cincinnati, visited a few days in Terre Haute, returning home by way of Indianapolis and attending Field Day.

Folsom, '92, attended Commencement but failed to appear at the banquet. Explanations are in order.

AFTERMATH.

Next day he wandered o'er the court
  Where their "love set" was played,
And sudden spied a treasure trove
  The crisp cut turf displayed—

Like a crinkled sunbeam
  Clasped by a jeweled star.
He took it into custody
  And murmured "Honi soit!"

The Vassar Miscellany.

ATHLETIC DEPARTMENT.

BASE BALL.

The Inter-Collegiate championship in base ball this season goes to Indiana University, that is, if the charges of "professionalism" against that team are disregarded.

The standing of the teams are as follows:

College.	Won.	Lost.	Per Cent
Indiana University	5	0	100
Rose Polytechnic	3	2	.60
Purdue University	2	3	.40
DePauw University	2	3	.40
Butler University	2	3	.40
Wabash College	1	4	20

The individual record of the Rose team is also given:

	Batting Average.	Fielding Average.
Anderson (2 games)	.250	.727
Austin	.350	.966
Brinker	.333	.888
Brown	.200	.923
Hedden	.174	.941
Hildreth	.227	.733
Martin	.235	.625
McCulloch (1 game)	.250	1000
Miller (2 games)	.111	.515
Stewart	.105	.842
Troxler	.428	.882

ROSE 12, *PURDUE* 7.

The game of base ball between R. P. I. and Purdue, which was to have been played May 5, was decided at the Base Ball Park, Indianapolis, on the morning of May 29.

The game was witnesed by an audience of about fifty people, the majority of whom were Polytechic students. Rose commenced to play ball from the start. Brown was given a base on balls, but was cut off while attempting to steal second. Hildreth batted to Boyles, at third, whose wild thrown to first let in the first run.

In the second inning Brinker went to first on balls, moved to third on Austin's two bag hit and increased the score on Martin's sacrifice. For the next three innings the small but select audience was treated to a fine exhibition of base ball.

Commencing with the sixth inning Rose batted Olin's delivery safely to almost every part of the field. Five runs were netted for Rose in this inning and four in the inning succeeding.

Not until the seventh inning did Purdue score. This was accomplished by good batting aided by errors for Rose—six runs were scored. Each side scored one run in the ninth, the result being 12 to 7.

The score is here given:

ROSE.

	A.B.	R.	1st B.	S. H.	P. O.	A.	E.
Brown, m.	3	2	2	0	2	0	0
Hildredth r.	5	3	1	0	0	0	0
Troxler, 3d	4	2	2	0	1	1	1
Hedden, 2d	5	1	1	0	2	9	0
Brinker, c	4	3	2	0	5	0	0
Austin, 1st	5	1	3	0	16	0	0
Miller, s. s.	5	0	0	1	1	2	1
Martin, l.	4	0	2	1	0	0	2
Stewart, p.	4	0	0	0	0	3	0
Totals	39	12	13	2	27	15	4

Earned runs, 7; 2 base hits, Austin, 2; 3 base hit, Hildreth; home run, Brinker; bases stolen, 4; bases on called balls, 3; bases on hit by pitched balls, 1; struck out by Stewart, 5; passed balls, 1; wild pitches, 1. Umpire, Smith.

PURDUE.

	A.B.	R.	1st B.	S. H.	P. O.	A.	E.
Kintner, c.	5	2	2	0	7	3	0
Myers, 2d	5	1	2	1	4	4	0
Olin, p.	5	1	2	0	0	3	0
Boyles, 3d	4	1	1	1	0	2	2
Fisher, 1st	5	1	1	0	11	0	1
Kerr, s. s.	4	1	1	0	4	1	0
Talbot, l	3	0	1	1	0	0	0
Moore, r.	4	0	0	2	0	0	1
Mudd, m.	4	0	1	0	1	1	1
Totals	39	7	11	5	27	14	5

Earned runs, 4; 2 base hit, Kintner; bases stolen, 3; bases on called balls, 2; struck out by Olin, 7; passed balls 1. Umpire, Kelly. Time of game, 2 hours.

SCORE BY INNINGS.

Rose	1	1	0	0	0	5	4	0	1	—12
Purdue	0	0	0	0	0	0	0	6	1	— 7

ROSE 11, *WABASH* 5.

The last scheduled game of the collegiate series was played June 2, with the Wabash College team at Crawfordsville.

One glaring feature of the game was the num-

ber of errors made by the infield of both teams.

The batting was good on both sides although Rose had the advantage.

The outfield work of Brown was excellent; Hedden and Allen also appeared to good advantage in their respective positions.

The game drifted entirely in one direction until the commencement of the ninth inning when Wabash succeeded in getting four runs. This was accomplished by a few choice errors on part of the Poly team, timely hits by Wabash and a few pathetic decisions by Umpire Horton.

Following is the score:

ROSE.

	A.B.	R.	1st B.	S. H.	P. O	A.	E.
Brown, m.	3	1	0	1	3	0	0
Hildreth, r.	5	2	1	0	4	1	1
Troxler, 3d	5	2	3	0	0	3	0
Hedden, 2d	5	3	1	1	5	2	0
Brinker, c.	3	1	3	0	2	0	1
Austin, 1st	5	0	1	1	11	0	1
Miller, s. s.	4	0	1	1	0	4	3
Martin, l.	4	0	1	0	1	0	0
Stewart, p.	4	2	1	0	1	1	1
Totals	42	11	12	4	27	10	7

Earned runs, 4; 2 base hits, 4; bases stolen, 5; double plays, 3; bases on called balls, 6; struck out by Stewart, 2. Umpire, McCulloch.

WABASH.

	A.B.	R.	1st B.	S. H.	P. O.	A.	E.
Huffer, s. s.	5	0	0	0	0	1	2
Gooding l.	4	1	0	0	0	1	1
Dorsey, 2d	5	1	2	0	1	3	1
Fry, m.	5	1	0	0	1	0	2
W. Whittington, r.	5	0	3	0	0	0	0
Johns, 3d	4	1	2	0	5	4	2
J. Whittington, p.	4	0	1	0	0	3	0
Todd, 1st	3	1	2	0	13	0	1
Allen, c.	4	0	1	0	4	3	0
Totals	39	5	11	0	24	15	9

Earned runs, 2; 2 base hit, 1; bases stolen, 3; bases on called balls, 3; bases on hit by pitched balls, 1; struck out by Whittington, 3. Umpire, Horton. Time of game, 2 hrs., 15 min.

SCORE BY INNINGS.

Wabash	0	0	0	1	0	0	0	0	4—5
Rose	0	0	3	0	1	4	2	1	*—11

WESTERN INTER-COLLEGIATE FIELD DAY

It was the good fortune of Rose this year to be able to send four men to the Western Association, at St. Louis, and these four—Darst, W. J. Klinger, P. W. Klinger and Ridgely—acquitted themselves in a most satisfactory manner. It is known to nearly all the students of Rose that the assistance and encouragement given by three members of the Alumni, Condron, Layman and Johannesen, made the trip of the contestants to St. Louis so thoroughly enjoyable.

The interest in "Poly" affairs, which is manifested by the Alumni in St. Louis, is one of the best external influences which reaches the undergraduates.

At this meet Illinois University took first place, winning over 70 points, or more than all others combined. Washington University was second with 27 points and Rose third with 26. The hammer throw of 110 feet made by Darst was a feature of this meeting. The meeting comes to Rose next year, and with it the offices of President and Secretary.

STATE FIELD DAY.

Few days if any during the college year have a greater charm for the average Poly than that day when in competition with the other college men of the state he strives for the honorable place, and according to his muscular ability and lung capacity makes himself felt and heard. At no time since the establishment of the inter-collegiate games in this state have the students of Rose Polytechnic been allowed the opportunity which was theirs at the recent meeting of May 29th. How well advantage was taken of that opportunity any one who witnessed the events of that day will bear testimony; and yet no student would care to be judged by what he accomplished on the track except so far as it indicates what may be expected from him in any honorable direction of usefulness.

From the commencement of the ball game at ten o'clock until the time of his departure from Indianapolis shortly before midnight the personality of the Poly was at no time obscured. The

disadvantages and inconveniences of the day were many but they have no place among the successes and will be considered by themselves.

The contests which were commenced soon after 2:30 p.m. lasted until 8:00 o'clock and the one event, running high jump, which was crowded out of the afternoon's program was decided in the Y. M. C. A. hall that evening. The events, together with positions and winning record, are here given with trial heats omitted:

Event.	Winner.	College.	Record.	Second.	College.	Record.	Third.	College.	No. of Contestants.
100 yards dash	Buschman	P. U.	10⅘ Sec.	Tod	P. U.		Little	W. C.	14
Putting 16 pounds shot	Cooper	P. U.	39′ 5″	Roller	D.P.U.	36′ 4″	Buschman	P. U.	13
Running broad jump	Coleman	E. C.	20′ 1″	J. Fry	W C.	19′ 6″	Hester	E. C.	12
One-fourth mile bicycle	W. J. Klinger	R. P. I.	31⅘″	P. W. Klinger	R. P. I.		Griffeth	P. U.	11
One mile walk	McCulloch	R. P. I.	8′ 7⅗″	Shaver	R. P. I.		John	D. P. U.	5
Pole vault	McMeans	R. P. I.	9′ 1o″	Ridgely	R. P. I	9′ 10″	Coleman	E. C.	12
Throwing base ball	Darst	R. P. I.	329′ 9″	Baker	B. U.	317′	Moore	P. U.	9
Standing high jump	Ewry	P. U	4′ 10″	Liggett	R. P. I.	4′ 9″	Roberts	B. U.	11
220 yards dash	McTaggart	R. P. I.	24″	Griffeth	P. U.		Little	W. C.	10
One-half mile bicycle	P. W. Klinger	R P. I.	1′ 9″	W. J. Klinger	R. P. I.		Pierson	E. C.	12
Hop, step and jump	Coleman	E. C.	42′	Warner	R. P. I.		Allen	W. C	10
120 yards hurdles	Crowell	P. U	18¾″	Decker	R. P. I.		Church	D. P. U.	8
Throwing 16 pounds hammer	Robertson	P. U.	98′ 3″	Darst	R. P. I.	93′ 8″	Buschman	P. U.	7
High kick	Ewry	P. U.	8′ 10″	Hellweg	R. P. I.	8′ 9″	Buschman	P. U.	10
One-fourth mile run	McTaggart	R. P. I.	54¾″	Moore	P. U.		Beckman	P. U.	11
One mile bicycle	P. W. Klinger	R. P. I.	2′ 41″	Pierson	E. C.		W. J. Klinger	R. P. I.	12
Running high jump	Haworth	E. C.	5′ 2″	Roberts	B. U	5′ 1″	Marshall	P. U.	11
Standing broad jump	Ewry	P. U.	10′ 5½″	Liggett	R. P. I.	10′ 4½″	Malone	W. C.	15
One mile run	Hester	E. C.	5′ 5″	Flanigan	W. C		Chandler	R. P. I.	14
Two mile bicycle	P. W. Klinger	R. P. I.	5′ 37″	W. J. Klinger	R. P. I.		Pierson	E. C.	12
Tennis doubles	Bender Bros.	B. U.							
Tennis singles	G. Bender	B. U.							
Pentathlon	Crowe	R. P. I		Crowell	P. U		Coleman	E C.	4

	Firsts.	Seconds.	Thirds.	Points.
R. P. I.	10	11	2	85
P. U.	7	4	6	53
E. C.	4	1	5	27
B. U.	2	2	1	17
W. C.	0	2	4	12
D. P. U.	0	1	2	5

GOOD IN THE RUSH LINE.

They never saw a football game,
Nor a long haired padded man;
But they are skillful, just the same,
Whene'er they "rush the can."

ROSE LEAVES.

COMMENCEMENT.

The tenth annual exercises of the Rose Polytechnic Institute at which the degree of Bachelor of Science was conferred upon the twenty-one members of the Senior class, and five former graduates received the degree of Master of Science, were observed in the college chapel Thursday, June 14th, commencing at 10 o'clock. The chapel stage presented a beautiful scene with its decorations of cut flowers. Seated on the platform were: President H. T. Eddy, Hon. Richard W. Thompson, president of the board of managers; Ray G. Jenckes, secretary; Demas Deming, treasurer; Hon. William Mack, Preston Hussey, Leslie D. Thomas and Robert S. Cox, all of the board of managers; Rev. Alexander, Hon. A. P. Stanton, of Indianapolis, former speaker of the House in the State Legislature, Col. T. Speed, of Louisville, Ky., and Mr. L. L. Anderson, also of Louisville, Ky.

An enjoyable programme of music was rendered at intervals in the other exercises by the Ringgold Orchestra. The opening prayer was made by the Rev. A. J. Alexander, of the Washington Avenue Church. The complete programme was as follows:

Music.
Prayer.
Music.
Theses.

(a) The Action of Sodium Ethylate in Di-nitro Phenyl-benzyl-methane.
(b) Derivatives of Camphoric Acid.
Elmer W. Brown.

The Variation of Magnetic Permeability of Wrought Iron, Cast Iron and Steel With the Degree of Saturation.
Sigurd L. Henrikson.

The Effect of Suddenly Applied Loads Upon the Tensile Strength of Wrought Iron.
J. C. Carlisle Holding and Edward F. Robinson.

A Study of the Terre Haute Fuel Gas Plant.
Walter M. Blinks and Austin V. H. Mory.

Music.

Test of the Union Station Lighting Plant.
David McCulloch and Paul Mischler.

Experimental Tests of the Deflections of Railroad Bridges for Different Loading.
Moton C. Andrews and Fred F. Hildreth.

The Density and Specific Heat of Solutions of Copper Sulphate and Silver Nitrate.
Hubert J. Kilbourne.

Test of Dynamo in Course of Construction at R. P. I. Shops.
Oran R. Hedden and Edward Riedel.

A Study of Strains in Iron Railway Bridge Under Different Conditions of Loading.
George H. Winters.

Music.

An Investigation of the Effect of the Presence of Different Gases Upon the Electro Chemical Equivalent.
Warwick M. Anderson and Charles E. Mendenhall.

Test of Gas Engine, Using Continuous Integrating Indicator.
James S. Royse and Howard M. Stanton.

The Volumetric Determination of Phosphorus in Steel.
Edward D. Frohman.

Disturbance in Telephony.
John F. Denehie and J. Buckner Speed.

*Incandescent Lamps.
Samuel D. Collett, B. S.

*Report on Tests of Steel by Punching.
Theo. L. Condron, B. S.

*Specifications for a 15 K. W. Direct Current Constant Potential Dynamo.
William J. Davis, Jr., B. S.

*The System of Sewers for Frankfort, Ind.
Alonzo J. Hammond, B. S.

*Studies in Alternating Currents.
W. Arnold Layman, B. S.

Music.
Presentation of Diplomas.
Award of Prizes.
Address to the Class.
Music.
Benediction.

*Were not read.

The graduating theses were prepared with great care and thoroughness and were therefore necessarily of extended length. Short abstracts of the theses were prepared by the authors and read by the following members of the class: Messrs. Brown, Henrikson, Holding, Mory, Mischler, Andrews, Kilbourne, Riedel, Winters, Mendenhall, Stanton, Frohman and Speed. The theses

of the candidates for the Master's degree were read by title only. The presentation of the diplomas was made by President Eddy. The candidates and the degrees conferred upon them were as follows:

BACHELOR OF SCIENCE.—COURSE IN ELECTRICAL ENGINEERING.

Warwick Miller Anderson . . . . . Louisville, Ky.
John Franklin Denehie . . . . . Terre Haute
Oran Roberts Hedden . . . . . Robinson, Ill.
Sigurd Lund Henrikson . . . . . Chicago, Ill.
David McCulloch . . . . . Indianapolis.
Charles Elwood Mendenhall . . . . Washington, D. C.
Paul Mischler . . . . . Terre Haute.
Edward Riedel . . . . . Cloverport, Ky.
James Samuel Royse . . . . . Terre Haute.
James Buckner Speed . . . . . Louisville, Ky.
Howard Maxwell Stanton . . . . . Indianapolis.

COURSE IN CIVIL ENGINEERING.

Morton Clark Andrews . . . . . State Line.
Fred Foster Hildreth . . . . . Bridge Hampton, N. Y.
James C. Carlisle Holding . . . . . Terre Haute.
Edgar Franklin Robinson . . . . . Earlington, Ky.
George Harold Winters . . . . . Dawn, O.

COURSE IN CHEMISTRY.

Walter Moulton Blinks . . . . . Michigan City.
Elmer William Brown . . . . . Terre Haute.
Edward Frohman . . . . . Cincinati, O.
Hubert Gorham Kilbourne . . . . . Terre Haute.
Austin Van Hoesen Mory . . . . . Manchester, Iowa.

MASTER OF SCIENCE.

Samuel Dunlap Collett, B. S . . . . . Clinton.
Theodore Lincoln Condron, B. S . . . Chicago, Ill.
William J. Davis, Jr., B. S . . . . . Louisville, Ky,
Alonzo John Hammond . . . . . Frankfort.
Waldo Arnold Layman . . . . . St. Louis, Mo.

The award of prizes was an interesting part of the programme. Those who have won special honors are as follows:

Heminway gold medal, awarded for highest standing during the whole course—Charles E. Mendenhall, Washington, D. C.

Bronze medal, for highest standing in Freshman year—Herman S. Heichert, Marion, Ind.

HONORABLE MENTION—SENIOR CLASS.

Morton C. Andrews, State Line.
Charles E. Mendenhall, Washington, D. C.

JUNIOR CLASS.

L. Edward Troxler, Louisville, Ky.
Edward A. Darst, Eureka, Ill.

SOPHOMORE CLASS.

Wallis R. Sanborn, Rockford, Ill.
Orange E. McMeans, Richmond.

FRESHMAN CLASS.

Jay H. Hall, Danville, Ill.
Benjamin F. Chandler, South Coventry, Conn.

The address to the class was made by the venerable friend of the institution and president of the board of managers, the Hon. Richard W. Thompson, who spoke in substance as follows:

"YOUNG GENTLEMEN:—Those diplomas which you hold in your hands do not contain stories of fiction. They are intended to signify to you the high esteem with which you are regarded by your tutors and the confidence which you have won from the Board of Managers who have conferred these honors upon you.

"I now in behalf of the board extend to you the sincere hope that they may be of service to you in long lives of usefulness. I do not know nor do you in what positions you will be placed. This I am right sure of—you will ever be an honor to your Alma Mater. * * * Whatever branch of science you may follow, remember that great things often have little beginnings. Not quite fifty years ago a friend in the city of New York asked me to go across the street to witness an experiment. I replied I knew how ingenious his Yankee friends were, but thought I hadn't time. He urged me and I went. We found there a venerable man, his head as white as mine now is. Beside him on a table was a piece of machinery and in the basement, but connected with this instrument by five miles of wire, was a similar one. He told me to ask him a question and his assistant in the basement would answer. 'Who will be the next president of the United States?' I asked. In about a minute the answer came back 'Henry Clay.' 'I don't know much about your machine, but I like its politics,' I replied. When I went back to the legislature I voted to have $25,000 of public money expended in a trial of Morse's telegraph, and where is the person who does not know the result? Thus you see from small beginnings great events ensue. Let me repeat, your course in life will depend on yourselves. With a strong

arm, firm purpose, honest heart and unflinching courage you may succeed, and not only your friends in this institution will rejoice, but you will make glad the hearts of those whose love as father, mother, brother or sister has encouraged you in the past"

Many visitors, including a number of former students and graduates attended the exercises. The following were present: L. L. Anderson, of Louisville, Ky.; Mr. and Mrs. Frohman, of Cinnati, Ohio; A. P. Stanton and Miss Stanton, of Indianapolis; T. Speed and daughter, of Louisville, Ky.; Mrs. Andrews and Miss Andrews, of State Line, Ind.

The exhibits in the various class rooms won merited praise from the visitors. The mechanical drawing room contained many of the drawings made by the Senior class. The free hand drawing room contained the principal features of the exhibit—the original drawings for the Sophomore sketch book, side by side with the photographic reproductions.

TRIP TO CRAWFORDSVILLE.

The special correspondent of THE TECHNIC accompanied the ball team to Crawfordsville.

The day was a favorable one both for travel and ball playing. The college buildings were visited and much interest was taken in examining the fine collection in the museum where every attention was shown the visitors. The library building was also visited and greatly admired. After dinner the team took half an hour of regular pratice, after which they remodeled the diamond and laid off the bases. Wabash made an effort to make the game interesting by securing two local players who, however, played a rather ordinary game. Umpire Horton was particularly generous in his efforts to encourage Wabash.

After the game the team was obliged to leave town in their base ball suits in order to catch the train. The familiar yells which had been practiced during Field Day were continuously repeated during the departure from town.

The boy got off the burning deck,
And stood up at the bat;
And gasped as the inshoot caught his neck,
"Ye Gods! Where am I at?"

—*Vanderbilt Hustler.*

DIFFERENTIALS.

Prof. Brown will as usual visit his old home in New Haven, Conn.

Dr. Noyes and family will again summer at Lake Delevan, Wis.

On the 12th seven applicants took examinations for entrance to the class of '98.

Of course the weather is warm. All those "hot" thesis drawings have been handed in.

Wade will spend his vacation at his home in Montana for the first time during his course.

D. W. Johnston, ex-'96, now of Purdue, spent several days in town after the close of his school.

Harry J. Holt and Henry G. Myers graduated from Purdue this year. They were old members of '94.

Mr. and Mrs. Place left on the sixth of the month for Ithaca, N. Y., where they will remain during the vacation.

A number of Polys seem to be unable to break the ties which bind them to Terre Haute and quite a colony yet remain in town.

The chapel has undergone the usual amount of rejuvenation for commencement; the windows have been washed and the floor scrubbed.

Mr. Smith will make an overland trip with the state geologist of Indiana, visiting the cave regions of Southern Indiana and Northern Kentucky.

Other than our own representative Mr. Huffer of Wabash seemed to be the only member of the managing committee able to cope with the Field Day work.

Prof. Howe with his family intends spending a great part of the vacation at the home of his parents, Northfield, Vt. Mrs. Howe will also visit in Boston and Columbus, Ohio.

The ravages of the photographic fiend are more numerous than usual this season. Perhaps the most interesting study in caricature is the picture of the chemical group. Send your order early to Blinks or Mory, and then pull out an insurance policy on your life.

The tie for first place in the pole vault, field day, by McMeans and Ridgley was decided in favor of the former on the Poly campus. Nine feet, six inches was the mark.

Burtis and Crowe intend keeping the non-alcoholic beverages of Terre Haute in sight, at the same time enjoying the invigorating breezes from the pellucid Wabash this summer.

The Normalites should have let "Snowball" play in one place long enough to become familiar with the business in hand. He might have won the game for them if they had let him alone.

A. V H. Mory will leave for Waltham, Mass., this week where he has accepted a position in superintending the erection of a gas plant. He will enjoy the magnificent scenery of the Hudson on his way thither.

A number of Polys were entertained at a picnic in Collett Park last Friday evening, given by Dr. and Mrs. Eddy in honor of Mrs. Hollingshead, who is visiting them. A most enjoyable time was spent by all.

The game of base ball played with the Normal team June 9 was characterized by the number of errors on each side, but the Normals played a much better game than last year, showing as a whole better team work and better batting. Score 18 to 8 in favor of the Poly team.

Prof. Kirchner is now in Indianapolis but expects to be in Terre Haute shortly after commencement. The Polys are sorry he could not run over before the close of school, they would have been pleased to offer their personal congratulations to their former professor as he will wed an Indianapolis young lady next fall.

Those who have had the pleasure of boarding with Mrs. W. C. Lawes are looking forward to a grand reunion ten years hence. Mrs. Lawes has sent out invitations reading for "yourself and family." The date for this meeting will be June 15, 1904. It is hinted that a handsome prize will be given to the largest family.

All the organizations, not to mention the individuals, of the Poly have been suddenly siezed with a desire to have their pictures taken. The base ball team and the athletes of Rose were photographed exceptionally well. McMeans and Ridgely had their images caught while vaulting over the pole and doing the flipp. The frats, Freshman class, chemists, civils, and Technic board all came in for their share of the craze. The photographers are right in it.

If there was a person who had the honor of riding home in the same car with the pennant from Field Day without paying respect to it, he probably will not care to be recognized. Even the conductor and the brakeman showed their appreciation by removing their caps when passing it. The plebeian from DePauw, whose verdancy failed to harmonize with his school colors, had no tribute of respect to offer and consequently returned home a sadder but wiser individual.

Perhaps the men of Butler do not know that it is customary to have two time keepers for each Pentathlon contestant. Thus they should have had eleven men equipped with stop watches instead of only three. Perhaps they are unaware that it is always best to notify a street car company to put on special cars to such out of the way places as fair grounds, when Field Day is going to be held. As it was, street cars were from twenty-five to forty minutes apart. A black board for announcing records should be used as well as to have them announced. Other pointers furnished on application.

W. J. Klinger went to Evansville to compete in the wheel races on the 15th. He secured first place in the quarter mile in $31\frac{2}{5}$ seconds, and brought home an elegant gold watch as a trophy.

E. J. Lake, a former member of the graduating class, spent Sunday with his friends and old classmates. He is pursuing the course in architecture at the University of Illinois, and in addition is assisting the professor of that department.

The 12 inst., that momentous day when precious bits of paper are handed out from the registrars office, was passed with less than the usual number of fatalities. The "tenth men" who were "knocked down" were comparatively few, there being only nine. Of these, three were Juniors, four were from section A. Sophomore and only two from the Freshman class. The exceedingly small number of failures in the Freshman class rather sustains the time honored theory that the degree of hardness of examinations varies as the number of students in the class. The present Freshman class began its career with fewer members than has any class for some years past.

THE COLLEGE WORLD.

A STUDY IN BLUE.

The sky is just as blue, to day,
As when I used to meet her
Down in the lane. No bud of May
Was more unspoiled or sweeter.

And she is still as fair, they say;—
Would that her heart were truer!—
The sky is just as blue to day,
But I'm a great deal bluer!—*Ex.*

Two hundred enthusiastic students of Stanford University have eachgiven $2.50 toward the construction of a "noise making machine," to be used at the next athletic contest between Leland Stanford and the University of California. It is to be a monster horn worked by a steam blower, and made of galvanized iron. It is to be fifty feet in length, with a diameter of ten feet, and will have a 32 horse-power boiler.—*Ex.*

The *University of Chicago Weekly* records the following: "The Senior class of Tufts college has elected a co-ed, as manager of the football team. And so we are to be driven from our last stand. We have left the banks, offices and stores to the female workers, and now they have taken our last and dearest occupation. O, what a time is this my countrymen! Come on with the millenium."

The corner stone of the great Pythian University, to be erected near Gallatin, Tenn., was laid May 2, with imposing ceremonies. The institution is being erected by the Knights of Pythias of the world, and is the first institution of its kind. The main building is to cost $100,000.—*U. of P. Courier.*

After a long and exciting strife between the upper two classes at DePauw, the Seniors now wear the cap and gown unmolested.

The Seniors are at a loss as to what to do in the matter of their theses—whether to work hard on the theses to make them acceptable, or to work hard on the professors to make them accept them. —*The Lantern.*

At Brown University, attendance at gymnasium is required of all students, and marks of faithfulness and attendance count like any study in determining class standing.—*U. of P. Courier.*

Ground has been broken for the new buildings of the University of New York. The old buildings will be torn down this summer and the new ones will be ready for use next fall.

An expedition has been sent out by Harvard on a collecting trip in Southern Mexico for the benefit of the University Museum. The party will be absent about three months.

The University of Minnesota has been increasing its field of usefulness by the erection of several new buildings and the addition of a number of strong men to its faculty.

A new game has been devised, by Dr. Sargent, of the Harvard Gymnasium, called "battle ball." It is a combination of baseball, cricket, football and tennis.

At Stanford University the faculty have organized among themselves a baseball nine, which has defeated every team the students have founded.—*Ex.*

All the studies in the Senior year have been made elective at Dartmouth.

The Chicago University has a women's glee club composed of sixteen members.

Nearly 300 young women are enrolled at Stanford University.

I walked one day with Phyllith
Ovah in Bothton town,
I in me long Pwince Albert,
She in a New Worth gown.

I talked that day with Phyllith
Over in Bothton town,
Of things intenth and thoulful,
Begged her me love to crown.

I pawted that day from Phyllith
Ovah in Bothton town;
She'd be a bwothah to me, she said,
But wouldn't be Mitheth Bwown.

—*Wesleyan Literary Monthly.*

The Irish National Football team is now champion of the three kingdoms, having defeated successively the English, Scotch and Welsh teams.

The Wesleyan University at Lincoln, Neb. recently lost a fine building by fire, and came near losing another.

Twenty-eight foreign countries and every American state and territory, except three, are represented at the University of Pennsylvania.

In the Eastern Inter-Collegiate Athletic contest Yale scored first place; Harvard second and U. of Penn. third.—*Crimson.*

Yale and Brown have each two tennis players ranked in the first ten in the country, while Harvard has one.

Both Yale and Harvard have verbally agreed to throw the mile walk out of their athletics in the future.—*Ex.*

Cameras are now used at Harvard and Cornell to show the faults of their crew candidates in rowing.

Twenty-five men are trying for positions on the Cornell lacrosse team.